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RxMix: A Simple Interface for Building Complex Applications from the RxNorm, RxTerms and NDF-RT APIs

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Developed at the National Library of Medicine, *RxMix* is a simple web interface for building complex applications using application programming interfaces (APIs) from any of three drug information sources – *RxNorm*, *RxTerms* (an interface terminology derived from *RxNorm*) and the Veterans Health Administration (VHA) National Drug File Reference Terminology (*NDF-RT*). *RxMix* is available at: http://mor.nlm.nih.gov/RxMix/.

Application Programming Interfaces (APIs) to *RxNorm*, *RxTerms* and *NDF-RT*

These web services APIs are publicly available, and have allowed users to integrate these three information sources in their computer programs since 2008. Usage has steadily increased over time, to over 50M queries in 2012.

RxNorm. The RxNorm API provides access to many features of *RxNorm*. For example, the API can be used for resolving "Zyrtec" into an *RxNorm* identifier (58930) and for finding which ingredients are associated with the branded drug "Bactrim 400 MG / 80 MG Oral Tablet" (Sulfamethoxazole + Trimethoprim). The API also helps resolve codes (e.g., NDCs) to *RxNorm* concepts and map obsolete identifiers to current ones.

RxTerms. The RxTerms API provides access to the physician-friendly display names created in *RxTerms* for clinical and branded drugs from *RxNorm*.

NDF-RT. The major functions of the *NDF-RT* API enable users to find an NDF-RT entity by name or by identifier and to traverse the rich network of relations in *NDF-RT*. Clinically-oriented functions associate drugs with their pharmacologic classes and can list all interacting drug for a given drug or test interaction for a given pair of drugs.

The *RxMix* application

RxMix allows users to create complex applications using the functions of the three APIs through a graphical interface, without the need for developing any programming code. With the ability to combine the functionality of the three APIs, the user can create a variety of applications for specific use cases. *RxMix* offers the user the choice of formatting the output in XML, JSON, or text. *RxMix* offers two major features:

- **Function composition.** The *RxMix* interface allows the user to perform complex queries by creating a workflow of API functions to execute. This saves the user from having to write complex programs to handle a sequence of function calls. *RxMix* helps users add interoperable functions to the workflow.
- **Batch processing.** Through the user interface, *RxMix* allows the user to process large amounts of data through the user defined workflow. The user can upload a file containing a list of values, such as drug names or drug identifiers, for input to the workflow. *RxMix* will execute the workflow on NLM servers and inform the user via email when the job has completed, providing information on how to retrieve the results. *RxMix* also allows users to interactively test and display the results of the workflow on a single input value.

Use cases

Different applications can be created using *RxMix* to solve various information needs. Some examples:

- Mapping a drug formulary or a list of NDC codes to *RxNorm* concepts (batch query over RxNorm).
- Find the list of clinical drugs in RxNorm corresponding to a given mechanism of action in NDF-RT (complex query over RxNorm and NDF-RT)
- Find the list of clinical drugs in RxNorm corresponding to an allergy class in NDF-RT (complex query over RxNorm and NDF-RT)

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